

Module manual for Materials Engineering (Master (1- Subject))



Examination Regulation Field



Module offer



Examination offer



Teaching offer

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**Examination Regulation Title & Version:
Materials Engineering (SPO Version / 2022)**

Title	Materials Engineering
Short title	MSMatEng
Version	2022
Study/Qualification Objectives	
Qualification Profile	
Additional information	

+ Materials Chemistry II (5212500)

Module titel	Materials Chemistry II (Compulsory subject)
Identifier	5212500
Version	Angelegt über RWTH API als 1
Duration (Semester)	one semester
Cycle (Semester)	winter/summer semester
Valid from	Winter semester 2021
Valid until	-
Module level	Bachelor/Master
Content	<ul style="list-style-type: none"> • Das chemische Gleichgewicht • Phasendiagramme • Die Eigenschaften von Mischungen • Statistische Thermodynamik • Die Geschwindigkeit chemischer Reaktionen • Elastische Eigenschaften • Die Eigenschaften von Oberflächen
Learning Objectives/ Learning Outcomes	<p>Wissen / Verstehen</p> <p>Die Studierenden lernen die Grundlagen der Werkstoffchemie kennen und können diese reproduzieren. Auch erkennen sie Zusammenhänge in der Werkstoffchemie und können diese erläutern.</p> <p>Anwenden / Analyse</p> <p>Dadurch werden Studierende befähigt das Erlernte auf unterschiedliche Aufgabenstellungen zu übertragen und entsprechend anzuwenden. Das Wissen wird in einer zugehörigen Übung angewendet und vertieft</p> <p>Synthese / Beurteilen</p> <p>Sie werden befähigt, thermodynamische und kinetische Eigenschaften von Materialien zu beurteilen, um die Auswahl geeigneter Werkstoffe für unterschiedliche Prozesse bzw. Anforderungen gezielt auswählen oder entwickeln zu können.</p>
(Study-Specific) Prerequisites	-
(recommended) Requirements	No requirements for admission to module; recommended: command of English, Materials Chemistry I
References	Lehrbuch: P.W. Atkins, Physikalische Chemie
Language	English
Examination Terms	Exam (English or German); additional voluntarily mid-term exam offered: improvement of the final exam grade by 0.3 (0.6) if > 80% (90%) in mid-term exam are obtained. Grade improvement only valid for exams within 1 year after the mid-term exam and only if regular exam is initially passed with 4.0. Improvement to grades better than 1.0 excluded.
Miscellaneous	-
Module coordinator	Modulangebotsorganisator: FB5 Modul-AVModellierungsteamverantwortlicher: Kimberly Meyer B. A. RWTHModulverantwortlicher: Universitätsprofessor Jochen Schneider Ph. D.
ECTS Credits	8

+ Materials Chemistry II (5212500)

Contact time (WSH)	6
Examination duration (min)	0
Total hours (h)	240,0
Contact hours (h)	90,0
Self-study hours (h)	150,0

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Materials Chemistry II (521250001)	1st semester	no semester recommended	8	0
Materials Chemistry II - Study Progress Check (521250002)	1st semester	no semester recommended	-	-

▲ Offer node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Materials Chemistry II - Übung englisch (Option 2)	1st semester	no semester recommended	-	2
Materials Chemistry II - Vorlesung	1st semester	no semester recommended	-	4
Materials Chemistry II - Übung deutsch (Option 1)	1st semester	no semester recommended	-	2

Module titel	Materials Science of Steel (Compulsory elective subject)
Identifier	5211533
Version	Angelegt über RWTH API als 1
Duration (Semester)	two semesters
Cycle (Semester)	summer semester
Valid from	Summer semester 2009
Valid until	-
Module level	Master
Content	<p>Basic aspects of strength, toughness, fracture: conventional stress-strain-diagram, influence of temperature and strain rate, yielding behaviour, thermal activated flow stress, superplasticity, anisotropy; strengthening mechanisms, materials failure: fracture mechanics, cold forming properties, high temperature behaviour; economical importance of steel; environmental aspects of steel production and products.</p> <p>High strength steels for automotive application, high strength structural steels, high temperature steels, multi-phase steels, special deep-drawing steels, rail steels</p>
Learning Objectives/ Learning Outcomes	<p>Students are able to link metal-physical phenomena with materials properties. They know methods and processes to analyse and influence corresponding materials properties. For selected processes, students are able to set up a process chain, including lifecycle assessment and cost effective analysis.</p> <p>For selected steel groups, students are proficient in defining correlations between microstructure and properties. They know the industrial implementation of these materials.</p>
(Study-Specific) Prerequisites	-
(recommended) Requirements	none
References	<p>- W. Bleck: Material Science of Steel, Verlag Mainz, 2007</p> <p>- W. Bleck: Material Testing, Verlag Mainz, 2007</p> <p>- handouts Additional literature references are given in lectures</p>
Language	English
Examination Terms	Written examination (50 %) + oral examination (50 %). Having successfully passed the laboratory is necessary for being admitted to the exam. The laboratory has been successfully completed when the respective certificate has been granted. Attendance at the laboratory is compulsory according to section 5 of the examination regulations of the course of studies.
Miscellaneous	-
Module coordinator	<p>Modulangebotsorganisator: FB5 Modul-AVModellierungsteamverantwortlicher: Kimberly Meyer B. A. RWTHModulverantwortlicher: Universitätsprofessor Dr.-Ing. Wolfgang Bleck</p>
ECTS Credits	8
Contact time (WSH)	7

- Materials Physics and Design
- Wahlpflichtbereich
- + Materials Science of Steel (5211533)

Examination duration (min)	0
Total hours (h)	240,0
Contact hours (h)	105,0
Self-study hours (h)	135,0

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Practical Training - Materials Science of Steel (521153302)	3rd semester	no semester recommended	0	4
Exam - Materials Science of Steel (521153301)	3rd semester	no semester recommended	8	0

▲ Offer node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Exercise - Materials Science of Steel	3rd semester	no semester recommended	-	1
Lecture - Materials Science of Steel	3rd semester	no semester recommended	-	2

Module titel	Entrepreneurship 101 - Thinking like an entrepreneur and becoming one (Compulsory elective subject)
Identifier	8023959
Version	v1
Duration (Semester)	more semesters
Cycle (Semester)	winter/summer semester
Valid from	Summer semester 2021
Valid until	-
Module level	Master
Content	<p>Participants first gain an insight into the field of entrepreneurship. They can then individually choose which focal topics in the field of entrepreneurship they would like to pursue, depending on their center of interest. Participants are offered a range of micromodules out of which they can design their individual learning path. This enables participants to customize the lecture based on their particular interest. Subjects to choose from, among others, include start-up financing, venture capital, entrepreneurial marketing as well as success factors of founding teams.</p> <p>The lecture takes place exclusively online via edX. The modules are self-paced, allowing participants to complete the modules at their individual learning pace.</p> <p>Due to the individually designable lecture, this course is suitable for participants with and without previous knowledge in this field.</p> <p>To gain an overall understanding of entrepreneurship, it is recommended to first select the micromodules "Thinking & Acting like an Entrepreneur".</p>
Learning Objectives/ Learning Outcomes	The aim of this course is to give the participant a basic insight into the topic of entrepreneurship on one hand, and to deepen their understanding in areas of particular interest on the other hand. This way, the participant gets to know different areas of entrepreneurship. Through exercises and quizzes, the new knowledge is directly applied and practiced.
(Study-Specific) Prerequisites	-
(recommended) Requirements	None.
References	-
Language	English
Examination Terms	Klausur (100%)
Miscellaneous	-
Module coordinator	Univ.-Prof. Dr. Malte Brettel
ECTS Credits	10
Contact time (WSH)	4
Examination duration (min)	-
Total hours (h)	300,0
Contact hours (h)	60,0

Self-study hours (h) 240,0

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 1 (802395901)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 2 (802395902)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 3 (802395903)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 4 (802395904)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Start-up CFO 1 (802395905)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Start-up CFO 2 (802395906)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Venture Capital 1 (802395907)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Venture Capital 2 (802395908)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Getting to Market 1 (802395909)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Getting to Market 2 (802395910)	3rd semester	no semester recommended	1	-

▲ Offer node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 1	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 2	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 3	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 4	3rd semester	no semester recommended	-	2

Entrepreneurship 101 - Start-up CFO 1	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Start-up CFO 2	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Venture Capital 1	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Venture Capital 2	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Getting to Market 1	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Getting to Market 2	3rd semester	no semester recommended	-	2

Module titel	Process Metallurgy and Recycling of Non-Ferrous Metals (Compulsory subject)
Identifier	5211522
Version	Angelegt über RWTH API als 1
Duration (Semester)	one semester
Cycle (Semester)	winter/summer semester
Valid from	Winter semester 2015
Valid until	-
Module level	Master
Content	<p>Non-ferrous metallurgy: Basics of nonferrous metallurgy: Economical significance, primary and secondary raw material, global material management.</p> <p>Metallurgical processes of Copper: Pyrometallurgy: flash smelting; Converter metallurgy and direct production; Recycling and pyrometallurgical Refining; Refining electrolysis and casting</p> <p>Metallurgical processes of Aluminium: Bauxite to Al-Hydroxide; Al-Hydroxide to Metal; Recycling, melt treatment and casting.</p> <p>Metallurgical processes of Zinc : Hydrometallurgy; Extraction electrolysis and hydrometallurgical Recycling; Pyrometallurgy; pyrometallurgical refining of lead and zinc</p> <p>Metallurgical processes of Titanium: Sorel-process, Kroll-process, remelting</p>
Learning Objectives/ Learning Outcomes	<p>Knowledge / Comprehension The students should become capable to understand the material flow, the primary and secondary processing route, the necessary aggregate with parameters of process and the chemical reaction in the metallurgical process of Copper, Aluminium, Zinc and Titanium, as well as the consideration of the problem of environment and location and especially energy requirements.</p> <p>Application/ Analysis Students apply the knowledge acquired about the different processing routes of NF-metals during the associated exercises. Synthesis / Evaluation Students gain skills to perform assessments of processing routes of NF-metals as well as the required units of operation.</p>
(Study-Specific) Prerequisites	-
(recommended) Requirements	Recommended: Materials Chemistry, Physical Chemistry
References	<ul style="list-style-type: none"> • Schmitz, C. Handbook of Aluminium Recycling - Fundamentals, Mechanical Preparation, Metallurgical Processing, Plant Design Vulkan Verlag GmbH, 2006, Essen ISBN 978 3 8027 2936 2 • Habashi, F. Handbook of Extractive Metallurgy; Vol. 1, 2 VCH Verlagsgesellschaft mbH, Weinheim 1997 ISBN 3 527 28792 2 • Ullmann's Encyclopedia of Industrial Chemistry; Vol. A1, A7,A14, A15, A26, A27, A28 VCH Verlagsgesellschaft mbH, Weinheim, 1985, Fifth Completely Revised Edition • O. Kubaschewski, E. Evans, C. Alcock, Metallurgical Thermochemistry, Pergamon Press Oxford, (1967)
Language	English
Examination Terms	Written exam
Miscellaneous	-
Module coordinator	<p>Modulangebotsorganisator: FB5 Modul-AVModellierungsteamverantwortlicher: Kimberly Meyer B. A. RWTHModulverantwortlicher:</p>

— Materials Physics and Design

— Fachspezifische Module

+ Process Metallurgy and Recycling of Non-Ferrous Metals (5211522)

	Universitätsprofessor Dr.-Ing. Dr. h. c. (UA) Karl Bernhard Friedrich
ECTS Credits	0
Contact time (WSH)	-
Examination duration (min)	0
Total hours (h)	,0
Contact hours (h)	-
Self-study hours (h)	-

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Process Metallurgy and Recycling of Non-Ferrous Materials Exam (521152201)	1st semester	no semester recommended	4	0

▲ Offer node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Process Metallurgy and Recycling of Non-Ferrous Materials Lecture	1st semester	no semester recommended	-	2
Process Metallurgy and Recycling of Non-Ferrous Materials Exercise	1st semester	no semester recommended	-	1

Module titel	Materials Science of Steel (Compulsory elective subject)
Identifier	5211533
Version	Angelegt über RWTH API als 1
Duration (Semester)	two semesters
Cycle (Semester)	summer semester
Valid from	Summer semester 2009
Valid until	-
Module level	Master
Content	<p>Basic aspects of strength, toughness, fracture: conventional stress-strain-diagram, influence of temperature and strain rate, yielding behaviour, thermal activated flow stress, superplasticity, anisotropy; strengthening mechanisms, materials failure: fracture mechanics, cold forming properties, high temperature behaviour; economical importance of steel; environmental aspects of steel production and products.</p> <p>High strength steels for automotive application, high strength structural steels, high temperature steels, multi-phase steels, special deep-drawing steels, rail steels</p>
Learning Objectives/ Learning Outcomes	<p>Students are able to link metal-physical phenomena with materials properties. They know methods and processes to analyse and influence corresponding materials properties. For selected processes, students are able to set up a process chain, including lifecycle assessment and cost effective analysis.</p> <p>For selected steel groups, students are proficient in defining correlations between microstructure and properties. They know the industrial implementation of these materials.</p>
(Study-Specific) Prerequisites	-
(recommended) Requirements	none
References	<p>- W. Bleck: Material Science of Steel, Verlag Mainz, 2007</p> <p>- W. Bleck: Material Testing,, Verlag Mainz, 2007</p> <p>- handouts Additional literature references are given in lectures</p>
Language	English
Examination Terms	Written examination (50 %) + oral examination (50 %). Having successfully passed the laboratory is necessary for being admitted to the exam. The laboratory has been successfully completed when the respective certificate has been granted. Attendance at the laboratory is compulsory according to section 5 of the examination regulations of the course of studies.
Miscellaneous	-
Module coordinator	<p>Modulangebotsorganisator: FB5 Modul-AVModellierungsteamverantwortlicher: Kimberly Meyer B. A. RWTHModulverantwortlicher: Universitätsprofessor Dr.-Ing. Wolfgang Bleck</p>
ECTS Credits	8
Contact time (WSH)	7

- Energy Materials
- Wahlpflichtbereich
- + Materials Science of Steel (5211533)

Examination duration (min)	0
Total hours (h)	240,0
Contact hours (h)	105,0
Self-study hours (h)	135,0

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Practical Training - Materials Science of Steel (521153302)	3rd semester	no semester recommended	0	4
Exam - Materials Science of Steel (521153301)	3rd semester	no semester recommended	8	0

▲ Offer node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Exercise - Materials Science of Steel	3rd semester	no semester recommended	-	1
Lecture - Materials Science of Steel	3rd semester	no semester recommended	-	2

Module titel	Entrepreneurship 101 - Thinking like an entrepreneur and becoming one (Compulsory elective subject)
Identifier	8023959
Version	v1
Duration (Semester)	more semesters
Cycle (Semester)	winter/summer semester
Valid from	Summer semester 2021
Valid until	-
Module level	Master
Content	<p>Participants first gain an insight into the field of entrepreneurship. They can then individually choose which focal topics in the field of entrepreneurship they would like to pursue, depending on their center of interest. Participants are offered a range of micromodules out of which they can design their individual learning path. This enables participants to customize the lecture based on their particular interest. Subjects to choose from, among others, include start-up financing, venture capital, entrepreneurial marketing as well as success factors of founding teams.</p> <p>The lecture takes place exclusively online via edX. The modules are self-paced, allowing participants to complete the modules at their individual learning pace.</p> <p>Due to the individually designable lecture, this course is suitable for participants with and without previous knowledge in this field.</p> <p>To gain an overall understanding of entrepreneurship, it is recommended to first select the micromodules "Thinking & Acting like an Entrepreneur".</p>
Learning Objectives/ Learning Outcomes	The aim of this course is to give the participant a basic insight into the topic of entrepreneurship on one hand, and to deepen their understanding in areas of particular interest on the other hand. This way, the participant gets to know different areas of entrepreneurship. Through exercises and quizzes, the new knowledge is directly applied and practiced.
(Study-Specific) Prerequisites	-
(recommended) Requirements	None.
References	-
Language	English
Examination Terms	Klausur (100%)
Miscellaneous	-
Module coordinator	Univ.-Prof. Dr. Malte Brettel
ECTS Credits	10
Contact time (WSH)	4
Examination duration (min)	-
Total hours (h)	300,0
Contact hours (h)	60,0

Self-study hours (h) 240,0

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 1 (802395901)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 2 (802395902)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 3 (802395903)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 4 (802395904)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Start-up CFO 1 (802395905)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Start-up CFO 2 (802395906)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Venture Capital 1 (802395907)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Venture Capital 2 (802395908)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Getting to Market 1 (802395909)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Getting to Market 2 (802395910)	3rd semester	no semester recommended	1	-

▲ Offer node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 1	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 2	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 3	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 4	3rd semester	no semester recommended	-	2

- Energy Materials
- Wahlpflichtbereich
- + Entrepreneurship 101 - Thinking like an entrepreneur and ...

Entrepreneurship 101 - Start-up CFO 1	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Start-up CFO 2	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Venture Capital 1	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Venture Capital 2	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Getting to Market 1	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Getting to Market 2	3rd semester	no semester recommended	-	2

Module titel	Software Tools for Integrated Computational Materials Design (Compulsory subject)
Identifier	5211548
Version	V2
Duration (Semester)	one semester
Cycle (Semester)	winter/summer semester
Valid from	Summer semester 2019
Valid until	-
Module level	Master
Content	<p>Various modelling approaches and software tools will be introduced and applied in small groups</p> <ul style="list-style-type: none"> • Density Functional Theory • Molecular Dynamics • CalPhad Method • Kampmann Wagner Approach • Phase Field Method • Finite Element Method • Crystal Plasticity-FEM • Representative Volume Elements • Continuum Damage Mechanics • Metallurgy enriched FE • Material properties modelling
Learning Objectives/ Learning Outcomes	<p>With in the course, an introduction into integrated material and process modelling will be given starting from density functional theory over microstructure simulation until simulation of mechanical properties of steels. Various models based on thermodynamical and thermomechanical approaches will be applied towards quantitative correlation of process, micro structure and properties. The course will give an overview on a representative selection of modelling approaches and software tools and it will introduce the application for steel alloy and production processes.</p>
(Study-Specific) Prerequisites	-
(recommended) Requirements	none
References	-
Language	English
Examination Terms	Written examination or oral examination
Miscellaneous	-
Module coordinator	<p>Modulangebotsorganisator: FB5 Modul-AVModellierungsteamverantwortlicher: Kimberly Meyer B. A. RWTHModulverantwortlicher: Universitätsprofessor Dr.-Ing. Wolfgang Bleck</p>
ECTS Credits	4
Contact time (WSH)	4
Examination duration (min)	-
Total hours (h)	120,0

— Energy Materials

— Fachspezifische Module

+ Software Tools for Integrated Computational Materials Design ...

Contact hours (h)	60,0
Self-study hours (h)	60,0

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Exam Software Tools for Integrated Computation Materials Design (521154801)	2nd semester	no semester recommended	4	0

▲ Offer node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Exercise - Software Tools for Integrated Computational Materials Design	2nd semester	no semester recommended	-	0
Lecture - Software Tools for Integrated Computational Materials Design	2nd semester	no semester recommended	-	4

Module titel	Fundamentals of Fracture Mechanics (Compulsory subject)
Identifier	5217605
Version	Angelegt über RWTH API als 1
Duration (Semester)	one semester
Cycle (Semester)	winter/summer semester
Valid from	Winter semester 2018
Valid until	-
Module level	Master
Content	-
Learning Objectives/ Learning Outcomes	-
(Study-Specific) Prerequisites	-
(recommended) Requirements	Knowledge of technical mechanics and materials engineering
References	-
Language	English
Examination Terms	Grading on the basis of the examination result (100% of the module grade); mandatory attendance at the experiments
Miscellaneous	-
Module coordinator	Modulangebotsorganisator: FB5 Modul-AVModellierungsteamverantwortlicher: Kimberly Meyer M. A. RWTHModulverantwortlicher: Unbekannt
ECTS Credits	8
Contact time (WSH)	7
Examination duration (min)	0
Total hours (h)	240,0
Contact hours (h)	105,0
Self-study hours (h)	135,0

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Practical - Fundamentals of Fracture Mechanics (521760502)	3rd semester	no semester recommended	0	1
Exam - Fundamentals of Fracture Mechanics (521760501)	3rd semester	no semester recommended	8	0

▲ Offer node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Lecture - Fundamentals of Fracture Mechanics	3rd semester	no semester recommended	-	2
Exercise - Fundamentals of Fracture Mechanics	3rd semester	no semester recommended	-	4

Module titel	Entrepreneurship 101 - Thinking like an entrepreneur and becoming one (Compulsory elective subject)
Identifier	8023959
Version	v1
Duration (Semester)	more semesters
Cycle (Semester)	winter/summer semester
Valid from	Summer semester 2021
Valid until	-
Module level	Master
Content	<p>Participants first gain an insight into the field of entrepreneurship. They can then individually choose which focal topics in the field of entrepreneurship they would like to pursue, depending on their center of interest. Participants are offered a range of micromodules out of which they can design their individual learning path. This enables participants to customize the lecture based on their particular interest. Subjects to choose from, among others, include start-up financing, venture capital, entrepreneurial marketing as well as success factors of founding teams.</p> <p>The lecture takes place exclusively online via edX. The modules are self-paced, allowing participants to complete the modules at their individual learning pace.</p> <p>Due to the individually designable lecture, this course is suitable for participants with and without previous knowledge in this field.</p> <p>To gain an overall understanding of entrepreneurship, it is recommended to first select the micromodules "Thinking & Acting like an Entrepreneur".</p>
Learning Objectives/ Learning Outcomes	The aim of this course is to give the participant a basic insight into the topic of entrepreneurship on one hand, and to deepen their understanding in areas of particular interest on the other hand. This way, the participant gets to know different areas of entrepreneurship. Through exercises and quizzes, the new knowledge is directly applied and practiced.
(Study-Specific) Prerequisites	-
(recommended) Requirements	None.
References	-
Language	English
Examination Terms	Klausur (100%)
Miscellaneous	-
Module coordinator	Univ.-Prof. Dr. Malte Brettel
ECTS Credits	10
Contact time (WSH)	4
Examination duration (min)	-
Total hours (h)	300,0
Contact hours (h)	60,0

Self-study hours (h) 240,0

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 1 (802395901)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 2 (802395902)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 3 (802395903)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 4 (802395904)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Start-up CFO 1 (802395905)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Start-up CFO 2 (802395906)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Venture Capital 1 (802395907)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Venture Capital 2 (802395908)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Getting to Market 1 (802395909)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Getting to Market 2 (802395910)	3rd semester	no semester recommended	1	-

▲ Offer node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 1	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 2	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 3	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 4	3rd semester	no semester recommended	-	2

— Materials Science of Steel

— Wahlpflichtbereich

+ Entrepreneurship 101 - Thinking like an entrepreneur and ...

Entrepreneurship 101 - Start-up CFO 1	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Start-up CFO 2	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Venture Capital 1	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Venture Capital 2	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Getting to Market 1	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Getting to Market 2	3rd semester	no semester recommended	-	2

Module titel	Software Tools for Integrated Computational Materials Design (Compulsory subject)
Identifier	5211548
Version	V2
Duration (Semester)	one semester
Cycle (Semester)	winter/summer semester
Valid from	Summer semester 2019
Valid until	-
Module level	Master
Content	<p>Various modelling approaches and software tools will be introduced and applied in small groups</p> <ul style="list-style-type: none"> • Density Functional Theory • Molecular Dynamics • CalPhad Method • Kampmann Wagner Approach • Phase Field Method • Finite Element Method • Crystal Plasticity-FEM • Representative Volume Elements • Continuum Damage Mechanics • Metallurgy enriched FE • Material properties modelling
Learning Objectives/ Learning Outcomes	<p>With in the course, an introduction into integrated material and process modelling will be given starting from density functional theory over microstructure simulation until simulation of mechanical properties of steels. Various models based on thermodynamical and thermomechanical approaches will be applied towards quantitative correlation of process, micro structure and properties. The course will give an overview on a representative selection of modelling approaches and software tools and it will introduce the application for steel alloy and production processes.</p>
(Study-Specific) Prerequisites	-
(recommended) Requirements	none
References	-
Language	English
Examination Terms	Written examination or oral examination
Miscellaneous	-
Module coordinator	<p>Modulangebotsorganisator: FB5 Modul-AVModellierungsteamverantwortlicher: Kimberly Meyer B. A. RWTHModulverantwortlicher: Universitätsprofessor Dr.-Ing. Wolfgang Bleck</p>
ECTS Credits	4
Contact time (WSH)	4
Examination duration (min)	-
Total hours (h)	120,0

— Materials Science of Steel

— Fachspezifische Module

+ Software Tools for Integrated Computational Materials Design ...

Contact hours (h)	60,0
Self-study hours (h)	60,0

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Exam Software Tools for Integrated Computation Materials Design (521154801)	2nd semester	no semester recommended	4	0

▲ Offer node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Exercise - Software Tools for Integrated Computational Materials Design	2nd semester	no semester recommended	-	0
Lecture - Software Tools for Integrated Computational Materials Design	2nd semester	no semester recommended	-	4

Module titel	Materials Characterisation (Compulsory subject)
Identifier	5211534
Version	Angelegt über RWTH API als 1
Duration (Semester)	one semester
Cycle (Semester)	winter/summer semester
Valid from	Summer semester 2009
Valid until	-
Module level	Master
Content	Tensile test, compression tests, long period creep test, bending test, hardness test, Charpy test, fracture mechanic test and fatigue test, safety analysis; non-destructive materials testing; FEM; technological testing
Learning Objectives/ Learning Outcomes	Students know common methods to characterise materials properties. They are able to perform and analyse selected experiments.
(Study-Specific) Prerequisites	-
(recommended) Requirements	none
References	- W. Bleck: Material Science of Steel, Verlag Mainz, 2007 - W. Bleck: Material Testing,, Verlag Mainz, 2007 - handouts Additional literature references are given in lectures
Language	English
Examination Terms	The students receive a certificate of participation if all experiments as well as the presentation of one of the experiments are passed successfully.
Miscellaneous	-
Module coordinator	Modulangebotsorganisator: FB5 Modul-AVModellierungsteamverantwortlicher: Kimberly Meyer B. A. RWTHModulverantwortlicher: Universitätsprofessor Dr.-Ing. Wolfgang Bleck
ECTS Credits	3
Contact time (WSH)	3
Examination duration (min)	0
Total hours (h)	90,0
Contact hours (h)	45,0
Self-study hours (h)	45,0

- Materials Science of Steel
- Fachspezifische Module
- + Materials Characterisation (5211534)

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Exercise/Practical Training - Materials Characterisation (521153401)	2nd semester	no semester recommended	3	3

Module titel	Process Metallurgy and Recycling of Iron and Steel (Compulsory subject)
Identifier	5211523
Version	Angelegt über RWTH API als 1
Duration (Semester)	one semester
Cycle (Semester)	winter/summer semester
Valid from	Winter semester 2015
Valid until	-
Module level	Master
Content	<ul style="list-style-type: none"> • Introduction, historical review; • preparation of ore, production of coke; • thermodynamic, heterogeneous equilibrium, kinetics; • reduction technology, production of Iron; • production of steel; • secondary metallurgy; • casting and solidification • slag in the production of Iron and steel • recycling of the steel scrapes • environment protection and sustainability
Learning Objectives/ Learning Outcomes	<p>Knowledge/Comprehension The students know the most important properties of the production of iron and steel. Application / Analysis The student should be able to describe the plant specific relationship between the aggregates of process, the thermo-chemical properties of each middle-production and the kinetical process procedure. Synthesis / Evaluation Students will get an overview of the steel production route. Further, they gain knowledge about the relation of thermodynamic calculations and industrial applications.</p>
(Study-Specific) Prerequisites	-
(recommended) Requirements	Recommended: Materials Chemistry, Physikalische Chemie
References	<ul style="list-style-type: none"> • F. Oeters, Metallurgy of Steelmaking, Springer Verlag Berlin/Heidelberg • The Making, Shaping and Treating of Steel, AISI Foundation, Pittsburg, 10th Edition • Steel Manual, Verlag Stahleisen Düsseldorf, (2008 or later) • A. Babich, D. Senk, H.W. Gudenau, K.Th. Mavrommatis, Ironmaking Textbook, IEHK, RWTH Aachen (2008) • Seshadri Seetharaman (ed.), Fundamentals of Metallurgy, Woodhead Publ. Cambridge, (2011)
Language	English
Examination Terms	Written exam
Miscellaneous	-
Module coordinator	<p>Modulangebotsorganisator: FB5 Modul-AVModellierungsteamverantwortlicher: Kimberly Meyer B. A. RWTHModulverantwortlicher: Universitätsprofessor Professor h. c. (CN) Dr.-Ing. Dr. h. c. (CZ) Dieter Georg Senk</p>
ECTS Credits	4
Contact time (WSH)	4
Examination duration (min)	0

- Materials Science of Steel
- Fachspezifische Module
- + Process Metallurgy and Recycling of Iron and Steel (5211523)

Total hours (h)	120,0
Contact hours (h)	60,0
Self-study hours (h)	60,0

● **Exam node**

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Process Metallurgy and Recycling of Iron and Steel Exam (521152301)	2nd semester	no semester recommended	4	0

▲ **Offer node**

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Process Metallurgy and Recycling of Iron and Steel Lecture	2nd semester	no semester recommended	-	2
Process Metallurgy and Recycling of Iron and Steel Exercise	2nd semester	no semester recommended	-	1

Module titel	Materials Science of Steel (Compulsory subject)
Identifier	5211533
Version	Angelegt über RWTH API als 1
Duration (Semester)	two semesters
Cycle (Semester)	summer semester
Valid from	Summer semester 2009
Valid until	-
Module level	Master
Content	<p>Basic aspects of strength, toughness, fracture: conventional stress-strain-diagram, influence of temperature and strain rate, yielding behaviour, thermal activated flow stress, superplasticity, anisotropy; strengthening mechanisms, materials failure: fracture mechanics, cold forming properties, high temperature behaviour; economical importance of steel; environmental aspects of steel production and products.</p> <p>High strength steels for automotive application, high strength structural steels, high temperature steels, multi-phase steels, special deep-drawing steels, rail steels</p>
Learning Objectives/ Learning Outcomes	<p>Students are able to link metal-physical phenomena with materials properties. They know methods and processes to analyse and influence corresponding materials properties. For selected processes, students are able to set up a process chain, including lifecycle assessment and cost effective analysis.</p> <p>For selected steel groups, students are proficient in defining correlations between microstructure and properties. They know the industrial implementation of these materials.</p>
(Study-Specific) Prerequisites	-
(recommended) Requirements	none
References	<p>- W. Bleck: Material Science of Steel, Verlag Mainz, 2007</p> <p>- W. Bleck: Material Testing,, Verlag Mainz, 2007</p> <p>- handouts Additional literature references are given in lectures</p>
Language	English
Examination Terms	Written examination (50 %) + oral examination (50 %). Having successfully passed the laboratory is necessary for being admitted to the exam. The laboratory has been successfully completed when the respective certificate has been granted. Attendance at the laboratory is compulsory according to section 5 of the examination regulations of the course of studies.
Miscellaneous	-
Module coordinator	<p>Modulangebotsorganisator: FB5 Modul-AVModellierungsteamverantwortlicher: Kimberly Meyer B. A. RWTHModulverantwortlicher: Universitätsprofessor Dr.-Ing. Wolfgang Bleck</p>
ECTS Credits	8
Contact time (WSH)	7

- Materials Science of Steel
- Fachspezifische Module
- + Materials Science of Steel (5211533)

Examination duration (min)	0
Total hours (h)	240,0
Contact hours (h)	105,0
Self-study hours (h)	135,0

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Practical Training - Materials Science of Steel (521153302)	3rd semester	no semester recommended	0	4
Exam - Materials Science of Steel (521153301)	3rd semester	no semester recommended	8	0

▲ Offer node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Exercise - Materials Science of Steel	3rd semester	no semester recommended	-	1
Lecture - Materials Science of Steel	3rd semester	no semester recommended	-	2

Module titel	Materials Science of Steel (Compulsory elective subject)
Identifier	5211533
Version	Angelegt über RWTH API als 1
Duration (Semester)	two semesters
Cycle (Semester)	summer semester
Valid from	Summer semester 2009
Valid until	-
Module level	Master
Content	<p>Basic aspects of strength, toughness, fracture: conventional stress-strain-diagram, influence of temperature and strain rate, yielding behaviour, thermal activated flow stress, superplasticity, anisotropy; strengthening mechanisms, materials failure: fracture mechanics, cold forming properties, high temperature behaviour; economical importance of steel; environmental aspects of steel production and products.</p> <p>High strength steels for automotive application, high strength structural steels, high temperature steels, multi-phase steels, special deep-drawing steels, rail steels</p>
Learning Objectives/ Learning Outcomes	<p>Students are able to link metal-physical phenomena with materials properties. They know methods and processes to analyse and influence corresponding materials properties. For selected processes, students are able to set up a process chain, including lifecycle assessment and cost effective analysis.</p> <p>For selected steel groups, students are proficient in defining correlations between microstructure and properties. They know the industrial implementation of these materials.</p>
(Study-Specific) Prerequisites	-
(recommended) Requirements	none
References	<p>- W. Bleck: Material Science of Steel, Verlag Mainz, 2007</p> <p>- W. Bleck: Material Testing,, Verlag Mainz, 2007</p> <p>- handouts Additional literature references are given in lectures</p>
Language	English
Examination Terms	Written examination (50 %) + oral examination (50 %). Having successfully passed the laboratory is necessary for being admitted to the exam. The laboratory has been successfully completed when the respective certificate has been granted. Attendance at the laboratory is compulsory according to section 5 of the examination regulations of the course of studies.
Miscellaneous	-
Module coordinator	<p>Modulangebotsorganisator: FB5 Modul-AVModellierungsteamverantwortlicher: Kimberly Meyer B. A. RWTHModulverantwortlicher: Universitätsprofessor Dr.-Ing. Wolfgang Bleck</p>
ECTS Credits	8
Contact time (WSH)	7

Examination duration (min)	0
Total hours (h)	240,0
Contact hours (h)	105,0
Self-study hours (h)	135,0

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Practical Training - Materials Science of Steel (521153302)	3rd semester	no semester recommended	0	4
Exam - Materials Science of Steel (521153301)	3rd semester	no semester recommended	8	0

▲ Offer node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Exercise - Materials Science of Steel	3rd semester	no semester recommended	-	1
Lecture - Materials Science of Steel	3rd semester	no semester recommended	-	2

Module titel	Entrepreneurship 101 - Thinking like an entrepreneur and becoming one (Compulsory elective subject)
Identifier	8023959
Version	v1
Duration (Semester)	more semesters
Cycle (Semester)	winter/summer semester
Valid from	Summer semester 2021
Valid until	-
Module level	Master
Content	<p>Participants first gain an insight into the field of entrepreneurship. They can then individually choose which focal topics in the field of entrepreneurship they would like to pursue, depending on their center of interest. Participants are offered a range of micromodules out of which they can design their individual learning path. This enables participants to customize the lecture based on their particular interest. Subjects to choose from, among others, include start-up financing, venture capital, entrepreneurial marketing as well as success factors of founding teams.</p> <p>The lecture takes place exclusively online via edX. The modules are self-paced, allowing participants to complete the modules at their individual learning pace.</p> <p>Due to the individually designable lecture, this course is suitable for participants with and without previous knowledge in this field.</p> <p>To gain an overall understanding of entrepreneurship, it is recommended to first select the micromodules "Thinking & Acting like an Entrepreneur".</p>
Learning Objectives/ Learning Outcomes	The aim of this course is to give the participant a basic insight into the topic of entrepreneurship on one hand, and to deepen their understanding in areas of particular interest on the other hand. This way, the participant gets to know different areas of entrepreneurship. Through exercises and quizzes, the new knowledge is directly applied and practiced.
(Study-Specific) Prerequisites	-
(recommended) Requirements	None.
References	-
Language	English
Examination Terms	Klausur (100%)
Miscellaneous	-
Module coordinator	Univ.-Prof. Dr. Malte Brettel
ECTS Credits	10
Contact time (WSH)	4
Examination duration (min)	-
Total hours (h)	300,0
Contact hours (h)	60,0

Self-study hours (h) 240,0

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 1 (802395901)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 2 (802395902)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 3 (802395903)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 4 (802395904)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Start-up CFO 1 (802395905)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Start-up CFO 2 (802395906)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Venture Capital 1 (802395907)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Venture Capital 2 (802395908)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Getting to Market 1 (802395909)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Getting to Market 2 (802395910)	3rd semester	no semester recommended	1	-

▲ Offer node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 1	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 2	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 3	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 4	3rd semester	no semester recommended	-	2

— Corrosion Engineering

— Wahlpflichtbereich

+ Entrepreneurship 101 - Thinking like an entrepreneur and ...

Entrepreneurship 101 - Start-up CFO 1	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Start-up CFO 2	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Venture Capital 1	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Venture Capital 2	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Getting to Market 1	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Getting to Market 2	3rd semester	no semester recommended	-	2

Module titel	Software Tools for Integrated Computational Materials Design (Compulsory subject)
Identifier	5211548
Version	V2
Duration (Semester)	one semester
Cycle (Semester)	winter/summer semester
Valid from	Summer semester 2019
Valid until	-
Module level	Master
Content	<p>Various modelling approaches and software tools will be introduced and applied in small groups</p> <ul style="list-style-type: none"> • Density Functional Theory • Molecular Dynamics • CalPhad Method • Kampmann Wagner Approach • Phase Field Method • Finite Element Method • Crystal Plasticity-FEM • Representative Volume Elements • Continuum Damage Mechanics • Metallurgy enriched FE • Material properties modelling
Learning Objectives/ Learning Outcomes	<p>With in the course, an introduction into integrated material and process modelling will be given starting from density functional theory over microstructure simulation until simulation of mechanical properties of steels. Various models based on thermodynamical and thermomechanical approaches will be applied towards quantitative correlation of process, micro structure and properties. The course will give an overview on a representative selection of modelling approaches and software tools and it will introduce the application for steel alloy and production processes.</p>
(Study-Specific) Prerequisites	-
(recommended) Requirements	none
References	-
Language	English
Examination Terms	Written examination or oral examination
Miscellaneous	-
Module coordinator	<p>Modulangebotsorganisator: FB5 Modul-AVModellierungsteamverantwortlicher: Kimberly Meyer B. A. RWTHModulverantwortlicher: Universitätsprofessor Dr.-Ing. Wolfgang Bleck</p>
ECTS Credits	4
Contact time (WSH)	4
Examination duration (min)	-
Total hours (h)	120,0

Contact hours (h)	60,0
Self-study hours (h)	60,0

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Exam Software Tools for Integrated Computation Materials Design (521154801)	2nd semester	no semester recommended	4	0

▲ Offer node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Exercise - Software Tools for Integrated Computational Materials Design	2nd semester	no semester recommended	-	0
Lecture - Software Tools for Integrated Computational Materials Design	2nd semester	no semester recommended	-	4

Module titel	Corrosion Control in Industries (Compulsory subject)
Identifier	5226452
Version	V1
Duration (Semester)	one semester
Cycle (Semester)	winter semester
Valid from	Winter semester 2021
Valid until	-
Module level	Master
Content	<p>Characteristic corrosion challenges in industries: automotive, air and aerospace, oil and gas, energy, chemistry and medicine</p> <p>Examples: hybrids (galvanic corrosion), pipeline (microbial corrosion), oil exploitation (sour gas corrosion), off-shore energy winning (aqueous corrosion), prosthesis materials (in-vivo corrosion), chemical engineering (acid corrosion), failure analysis</p>
Learning Objectives/ Learning Outcomes	The students learn of recent and novel corrosion engineering challenges for advanced materials in relevant and strategic industrial branches. They are able to evaluate requirements for custom-designed corrosion concepts and are aware of the necessity of innovative, high-developed corrosion control.
(Study-Specific) Prerequisites	-
(recommended) Requirements	Fundamentals of Corrosion Science
References	<ul style="list-style-type: none"> - Principles and prevention of Corrosion, D.A. Jones, Prentice Hall, Inc. 1996 - Uhlig`s corrosion handbook, R. Winston Revie, John Wiley & Sons Inc 2000 - handouts - Additional literature suggestions are given in lectures
Language	English
Examination Terms	Written exam weighted 100%
Miscellaneous	-
Module coordinator	-
ECTS Credits	3
Contact time (WSH)	3
Examination duration (min)	-
Total hours (h)	90,0
Contact hours (h)	45,0
Self-study hours (h)	45,0

- Corrosion Engineering
- Fachspezifische Module
- + Corrosion Control in Industries (5226452)

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Corrosion Control in Industries Exam (522645201)	3rd semester	no semester recommended	3	-

▲ Offer node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Lecture Corrosion Control in Industries	3rd semester	no semester recommended	-	2
Exercise Corrosion Control in Industries	3rd semester	no semester recommended	-	1

Module titel	Materials Science of Steel (Compulsory elective subject)
Identifier	5211533
Version	Angelegt über RWTH API als 1
Duration (Semester)	two semesters
Cycle (Semester)	summer semester
Valid from	Summer semester 2009
Valid until	-
Module level	Master
Content	<p>Basic aspects of strength, toughness, fracture: conventional stress-strain-diagram, influence of temperature and strain rate, yielding behaviour, thermal activated flow stress, superplasticity, anisotropy; strengthening mechanisms, materials failure: fracture mechanics, cold forming properties, high temperature behaviour; economical importance of steel; environmental aspects of steel production and products.</p> <p>High strength steels for automotive application, high strength structural steels, high temperature steels, multi-phase steels, special deep-drawing steels, rail steels</p>
Learning Objectives/ Learning Outcomes	<p>Students are able to link metal-physical phenomena with materials properties. They know methods and processes to analyse and influence corresponding materials properties. For selected processes, students are able to set up a process chain, including lifecycle assessment and cost effective analysis.</p> <p>For selected steel groups, students are proficient in defining correlations between microstructure and properties. They know the industrial implementation of these materials.</p>
(Study-Specific) Prerequisites	-
(recommended) Requirements	none
References	<p>- W. Bleck: Material Science of Steel, Verlag Mainz, 2007</p> <p>- W. Bleck: Material Testing,, Verlag Mainz, 2007</p> <p>- handouts Additional literature references are given in lectures</p>
Language	English
Examination Terms	Written examination (50 %) + oral examination (50 %). Having successfully passed the laboratory is necessary for being admitted to the exam. The laboratory has been successfully completed when the respective certificate has been granted. Attendance at the laboratory is compulsory according to section 5 of the examination regulations of the course of studies.
Miscellaneous	-
Module coordinator	<p>Modulangebotsorganisator: FB5 Modul-AVModellierungsteamverantwortlicher: Kimberly Meyer B. A. RWTHModulverantwortlicher: Universitätsprofessor Dr.-Ing. Wolfgang Bleck</p>
ECTS Credits	8
Contact time (WSH)	7

- Structural Integrity
- Wahlpflichtbereich
- + Materials Science of Steel (5211533)

Examination duration (min)	0
Total hours (h)	240,0
Contact hours (h)	105,0
Self-study hours (h)	135,0

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Practical Training - Materials Science of Steel (521153302)	3rd semester	no semester recommended	0	4
Exam - Materials Science of Steel (521153301)	3rd semester	no semester recommended	8	0

▲ Offer node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Exercise - Materials Science of Steel	3rd semester	no semester recommended	-	1
Lecture - Materials Science of Steel	3rd semester	no semester recommended	-	2

Module titel	Entrepreneurship 101 - Thinking like an entrepreneur and becoming one (Compulsory elective subject)
Identifier	8023959
Version	v1
Duration (Semester)	more semesters
Cycle (Semester)	winter/summer semester
Valid from	Summer semester 2021
Valid until	-
Module level	Master
Content	<p>Participants first gain an insight into the field of entrepreneurship. They can then individually choose which focal topics in the field of entrepreneurship they would like to pursue, depending on their center of interest. Participants are offered a range of micromodules out of which they can design their individual learning path. This enables participants to customize the lecture based on their particular interest. Subjects to choose from, among others, include start-up financing, venture capital, entrepreneurial marketing as well as success factors of founding teams.</p> <p>The lecture takes place exclusively online via edX. The modules are self-paced, allowing participants to complete the modules at their individual learning pace.</p> <p>Due to the individually designable lecture, this course is suitable for participants with and without previous knowledge in this field.</p> <p>To gain an overall understanding of entrepreneurship, it is recommended to first select the micromodules "Thinking & Acting like an Entrepreneur".</p>
Learning Objectives/ Learning Outcomes	The aim of this course is to give the participant a basic insight into the topic of entrepreneurship on one hand, and to deepen their understanding in areas of particular interest on the other hand. This way, the participant gets to know different areas of entrepreneurship. Through exercises and quizzes, the new knowledge is directly applied and practiced.
(Study-Specific) Prerequisites	-
(recommended) Requirements	None.
References	-
Language	English
Examination Terms	Klausur (100%)
Miscellaneous	-
Module coordinator	Univ.-Prof. Dr. Malte Brettel
ECTS Credits	10
Contact time (WSH)	4
Examination duration (min)	-
Total hours (h)	300,0
Contact hours (h)	60,0

- Structural Integrity
- Wahlpflichtbereich
- + Entrepreneurship 101 - Thinking like an entrepreneur and ...

Self-study hours (h) 240,0

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 1 (802395901)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 2 (802395902)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 3 (802395903)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 4 (802395904)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Start-up CFO 1 (802395905)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Start-up CFO 2 (802395906)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Venture Capital 1 (802395907)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Venture Capital 2 (802395908)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Getting to Market 1 (802395909)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Getting to Market 2 (802395910)	3rd semester	no semester recommended	1	-

▲ Offer node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 1	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 2	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 3	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 4	3rd semester	no semester recommended	-	2

- Structural Integrity
- Wahlpflichtbereich
- + Entrepreneurship 101 - Thinking like an entrepreneur and ...

Entrepreneurship 101 - Start-up CFO 1	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Start-up CFO 2	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Venture Capital 1	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Venture Capital 2	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Getting to Market 1	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Getting to Market 2	3rd semester	no semester recommended	-	2

Module titel	Software Tools for Integrated Computational Materials Design (Compulsory subject)
Identifier	5211548
Version	V2
Duration (Semester)	one semester
Cycle (Semester)	winter/summer semester
Valid from	Summer semester 2019
Valid until	-
Module level	Master
Content	<p>Various modelling approaches and software tools will be introduced and applied in small groups</p> <ul style="list-style-type: none"> • Density Functional Theory • Molecular Dynamics • CalPhad Method • Kampmann Wagner Approach • Phase Field Method • Finite Element Method • Crystal Plasticity-FEM • Representative Volume Elements • Continuum Damage Mechanics • Metallurgy enriched FE • Material properties modelling
Learning Objectives/ Learning Outcomes	<p>With in the course, an introduction into integrated material and process modelling will be given starting from density functional theory over microstructure simulation until simulation of mechanical properties of steels. Various models based on thermodynamical and thermomechanical approaches will be applied towards quantitative correlation of process, micro structure and properties. The course will give an overview on a representative selection of modelling approaches and software tools and it will introduce the application for steel alloy and production processes.</p>
(Study-Specific) Prerequisites	-
(recommended) Requirements	none
References	-
Language	English
Examination Terms	Written examination or oral examination
Miscellaneous	-
Module coordinator	<p>Modulangebotsorganisator: FB5 Modul-AVModellierungsteamverantwortlicher: Kimberly Meyer B. A. RWTHModulverantwortlicher: Universitätsprofessor Dr.-Ing. Wolfgang Bleck</p>
ECTS Credits	4
Contact time (WSH)	4
Examination duration (min)	-
Total hours (h)	120,0

- Structural Integrity
- Fachspezifische Module
- + Software Tools for Integrated Computational Materials Design ...

Contact hours (h)	60,0
Self-study hours (h)	60,0

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Exam Software Tools for Integrated Computation Materials Design (521154801)	2nd semester	no semester recommended	4	0

▲ Offer node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Exercise - Software Tools for Integrated Computational Materials Design	2nd semester	no semester recommended	-	0
Lecture - Software Tools for Integrated Computational Materials Design	2nd semester	no semester recommended	-	4

Module titel	Materials Characterisation (Compulsory subject)
Identifier	5211534
Version	Angelegt über RWTH API als 1
Duration (Semester)	one semester
Cycle (Semester)	winter/summer semester
Valid from	Summer semester 2009
Valid until	-
Module level	Master
Content	Tensile test, compression tests, long period creep test, bending test, hardness test, Charpy test, fracture mechanic test and fatigue test, safety analysis; non-destructive materials testing; FEM; technological testing
Learning Objectives/ Learning Outcomes	Students know common methods to characterise materials properties. They are able to perform and analyse selected experiments.
(Study-Specific) Prerequisites	-
(recommended) Requirements	none
References	- W. Bleck: Material Science of Steel, Verlag Mainz, 2007 - W. Bleck: Material Testing,, Verlag Mainz, 2007 - handouts Additional literature references are given in lectures
Language	English
Examination Terms	The students receive a certificate of participation if all experiments as well as the presentation of one of the experiments are passed successfully.
Miscellaneous	-
Module coordinator	Modulangebotsorganisator: FB5 Modul-AVModellierungsteamverantwortlicher: Kimberly Meyer B. A. RWTHModulverantwortlicher: Universitätsprofessor Dr.-Ing. Wolfgang Bleck
ECTS Credits	3
Contact time (WSH)	3
Examination duration (min)	0
Total hours (h)	90,0
Contact hours (h)	45,0
Self-study hours (h)	45,0

- Structural Integrity
- Fachspezifische Module
- + Materials Characterisation (5211534)

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Exercise/Practical Training - Materials Characterisation (521153401)	2nd semester	no semester recommended	3	3

Module titel	Fundamentals of Damage Mechanics and Material Modelling (Compulsory subject)
Identifier	5217606
Version	Angelegt über RWTH API als 1
Duration (Semester)	one semester
Cycle (Semester)	winter/summer semester
Valid from	Winter semester 2018
Valid until	-
Module level	Master
Content	-
Learning Objectives/ Learning Outcomes	-
(Study-Specific) Prerequisites	-
(recommended) Requirements	Knowledge of technical mechanics and materials engineering
References	-
Language	English
Examination Terms	Grading on the basis of the examination result (100% of the module grade); mandatory attendance at the experiments.
Miscellaneous	-
Module coordinator	Modulangebotsorganisator: FB5 Modul-AVModellierungsteamverantwortlicher: Kimberly Meyer M. A. RWTHModulverantwortlicher: Unbekannt
ECTS Credits	8
Contact time (WSH)	7
Examination duration (min)	0
Total hours (h)	240,0
Contact hours (h)	105,0
Self-study hours (h)	135,0

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Practical - Fundamentals of Damage Mechanics and Material Modelling (521760602)	2nd semester	no semester recommended	0	1
Exam - Fundamentals of Damage Mechanics and Material Modelling (521760601)	2nd semester	no semester recommended	8	0

▲ Offer node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Excercise - Fundamentals of Damage Mechanics and Material Modelling	2nd semester	no semester recommended	-	2
Lecture - Fundamentals of Damage Mechanics and Material Modelling	2nd semester	no semester recommended	-	4

Module titel	Corrosion Control in Industries (Compulsory subject)
Identifier	5226452
Version	V1
Duration (Semester)	one semester
Cycle (Semester)	winter semester
Valid from	Winter semester 2021
Valid until	-
Module level	Master
Content	<p>Characteristic corrosion challenges in industries: automotive, air and aerospace, oil and gas, energy, chemistry and medicine</p> <p>Examples: hybrids (galvanic corrosion), pipeline (microbial corrosion), oil exploitation (sour gas corrosion), off-shore energy winning (aqueous corrosion), prosthesis materials (in-vivo corrosion), chemical engineering (acid corrosion), failure analysis</p>
Learning Objectives/ Learning Outcomes	The students learn of recent and novel corrosion engineering challenges for advanced materials in relevant and strategic industrial branches. They are able to evaluate requirements for custom-designed corrosion concepts and are aware of the necessity of innovative, high-developed corrosion control.
(Study-Specific) Prerequisites	-
(recommended) Requirements	Fundamentals of Corrosion Science
References	<ul style="list-style-type: none"> - Principles and prevention of Corrosion, D.A. Jones, Prentice Hall, Inc. 1996 - Uhlig`s corrosion handbook, R. Winston Revie, John Wiley & Sons Inc 2000 - handouts - Additional literature suggestions are given in lectures
Language	English
Examination Terms	Written exam weighted 100%
Miscellaneous	-
Module coordinator	-
ECTS Credits	3
Contact time (WSH)	3
Examination duration (min)	-
Total hours (h)	90,0
Contact hours (h)	45,0
Self-study hours (h)	45,0

- Structural Integrity
- Fachspezifische Module
- + Corrosion Control in Industries (5226452)

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Corrosion Control in Industries Exam (522645201)	3rd semester	no semester recommended	3	-

▲ Offer node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Lecture Corrosion Control in Industries	3rd semester	no semester recommended	-	2
Exercise Corrosion Control in Industries	3rd semester	no semester recommended	-	1

Module titel	Fundamentals and Solving Methods in Metal Forming (Compulsory subject)
Identifier	5211536
Version	V2
Duration (Semester)	one semester
Cycle (Semester)	winter/summer semester
Valid from	Winter semester 2018
Valid until	-
Module level	Master
Content	<ul style="list-style-type: none"> • Basics of plastomechanics, stress and deformation states, yield law, differential equations for elementary theory, boundary conditions • Elementary theory for basic metal forming processes • Similarity theorem and modelling techniques, basics of FEM
Learning Objectives/ Learning Outcomes	<ul style="list-style-type: none"> • Knowledge: The students know the possibilities and boundaries of solving methods in metal forming including FEM and similarity theory. • Understanding: The students have a detailed understanding of plastomechanics. • Application and Analysis: The students are able to analyse the basic processes in metal forming, to choose an adequate solving method and to derive the elementary coherences to describe and estimate certain metal forming processes. • Practice: In the practical course, the students learn the possible applications of FEM in the field of forming technology by means of practice-oriented application cases. For this purpose, the students use CLiPS, a web-based application for performing FE simulations, in self-study. Accompanying reports and mutual peer reviews promote the competences in the field of independent research.
(Study-Specific) Prerequisites	-
(recommended) Requirements	none
References	T. Altan: Metal forming, American Society for Metals Lange: Handbook of Metal Forming, Volume 1
Language	English
Examination Terms	Admission only after successfully completion of the practical experiments (Laboratory). Written exam
Miscellaneous	-
Module coordinator	Modulangebotsorganisator: FB5 Modul-AVModellierungsteamverantwortlicher: Kimberly Meyer M. A. RWTHModulverantwortlicher: Universitätsprofessor Dr.-Ing. Gerhard Hirt
ECTS Credits	8
Contact time (WSH)	-

- Structural Integrity
- Fachspezifische Module
- + Fundamentals and Solving Methods in Metal Forming (5211536)

Examination duration (min)	-
Total hours (h)	240,0
Contact hours (h)	-
Self-study hours (h)	-

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Laboratory - Fundamentals and Solving Methods in Metal Forming (521153602)	3rd semester	no semester recommended	0	3
Exam - Fundamentals and Solving Methods in Metal Forming (521153601)	3rd semester	no semester recommended	8	0

▲ Offer node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Lecture - Fundamentals and Solving Methods in Metal Forming	3rd semester	no semester recommended	-	2
Tutorial - Fundamentals and Solving Methods in Metal Forming	3rd semester	no semester recommended	-	2

- Structural Integrity
- Fachspezifische Module
- + Fundamentals of Fracture Mechanics (5217605)

Module titel	Fundamentals of Fracture Mechanics (Compulsory subject)
Identifier	5217605
Version	Angelegt über RWTH API als 1
Duration (Semester)	one semester
Cycle (Semester)	winter/summer semester
Valid from	Winter semester 2018
Valid until	-
Module level	Master
Content	-
Learning Objectives/ Learning Outcomes	-
(Study-Specific) Prerequisites	-
(recommended) Requirements	Knowledge of technical mechanics and materials engineering
References	-
Language	English
Examination Terms	Grading on the basis of the examination result (100% of the module grade); mandatory attendance at the experiments
Miscellaneous	-
Module coordinator	Modulangebotsorganisator: FB5 Modul-AVModellierungsteamverantwortlicher: Kimberly Meyer M. A. RWTHModulverantwortlicher: Unbekannt
ECTS Credits	8
Contact time (WSH)	7
Examination duration (min)	0
Total hours (h)	240,0
Contact hours (h)	105,0
Self-study hours (h)	135,0

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Practical - Fundamentals of Fracture Mechanics (521760502)	3rd semester	no semester recommended	0	1
Exam - Fundamentals of Fracture Mechanics (521760501)	3rd semester	no semester recommended	8	0

▲ Offer node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Lecture - Fundamentals of Fracture Mechanics	3rd semester	no semester recommended	-	2
Exercise - Fundamentals of Fracture Mechanics	3rd semester	no semester recommended	-	4

Module titel	Materials Science of Steel (Compulsory elective subject)
Identifier	5211533
Version	Angelegt über RWTH API als 1
Duration (Semester)	two semesters
Cycle (Semester)	summer semester
Valid from	Summer semester 2009
Valid until	-
Module level	Master
Content	<p>Basic aspects of strength, toughness, fracture: conventional stress-strain-diagram, influence of temperature and strain rate, yielding behaviour, thermal activated flow stress, superplasticity, anisotropy; strengthening mechanisms, materials failure: fracture mechanics, cold forming properties, high temperature behaviour; economical importance of steel; environmental aspects of steel production and products.</p> <p>High strength steels for automotive application, high strength structural steels, high temperature steels, multi-phase steels, special deep-drawing steels, rail steels</p>
Learning Objectives/ Learning Outcomes	<p>Students are able to link metal-physical phenomena with materials properties. They know methods and processes to analyse and influence corresponding materials properties. For selected processes, students are able to set up a process chain, including lifecycle assessment and cost effective analysis.</p> <p>For selected steel groups, students are proficient in defining correlations between microstructure and properties. They know the industrial implementation of these materials.</p>
(Study-Specific) Prerequisites	-
(recommended) Requirements	none
References	<ul style="list-style-type: none"> - W. Bleck: Material Science of Steel, Verlag Mainz, 2007 - W. Bleck: Material Testing,, Verlag Mainz, 2007 - handouts Additional literature references are given in lectures
Language	English
Examination Terms	Written examination (50 %) + oral examination (50 %). Having successfully passed the laboratory is necessary for being admitted to the exam. The laboratory has been successfully completed when the respective certificate has been granted. Attendance at the laboratory is compulsory according to section 5 of the examination regulations of the course of studies.
Miscellaneous	-
Module coordinator	Modulangebotsorganisator: FB5 Modul-AVModellierungsteamverantwortlicher: Kimberly Meyer B. A. RWTHModulverantwortlicher: Universitätsprofessor Dr.-Ing. Wolfgang Bleck
ECTS Credits	8
Contact time (WSH)	7

- Sustainable Process Metallurgy and Metal ...
- Wahlpflichtbereich
- + Materials Science of Steel (5211533)

Examination duration (min)	0
Total hours (h)	240,0
Contact hours (h)	105,0
Self-study hours (h)	135,0

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Practical Training - Materials Science of Steel (521153302)	3rd semester	no semester recommended	0	4
Exam - Materials Science of Steel (521153301)	3rd semester	no semester recommended	8	0

▲ Offer node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Exercise - Materials Science of Steel	3rd semester	no semester recommended	-	1
Lecture - Materials Science of Steel	3rd semester	no semester recommended	-	2

- Sustainable Process Metallurgy and Metal ...
- Wahlpflichtbereich
- + Entrepreneurship 101 - Thinking like an entrepreneur and ...

Module titel	Entrepreneurship 101 - Thinking like an entrepreneur and becoming one (Compulsory elective subject)
Identifier	8023959
Version	v1
Duration (Semester)	more semesters
Cycle (Semester)	winter/summer semester
Valid from	Summer semester 2021
Valid until	-
Module level	Master
Content	<p>Participants first gain an insight into the field of entrepreneurship. They can then individually choose which focal topics in the field of entrepreneurship they would like to pursue, depending on their center of interest. Participants are offered a range of micromodules out of which they can design their individual learning path. This enables participants to customize the lecture based on their particular interest. Subjects to choose from, among others, include start-up financing, venture capital, entrepreneurial marketing as well as success factors of founding teams.</p> <p>The lecture takes place exclusively online via edX. The modules are self-paced, allowing participants to complete the modules at their individual learning pace.</p> <p>Due to the individually designable lecture, this course is suitable for participants with and without previous knowledge in this field.</p> <p>To gain an overall understanding of entrepreneurship, it is recommended to first select the micromodules "Thinking & Acting like an Entrepreneur".</p>
Learning Objectives/ Learning Outcomes	The aim of this course is to give the participant a basic insight into the topic of entrepreneurship on one hand, and to deepen their understanding in areas of particular interest on the other hand. This way, the participant gets to know different areas of entrepreneurship. Through exercises and quizzes, the new knowledge is directly applied and practiced.
(Study-Specific) Prerequisites	-
(recommended) Requirements	None.
References	-
Language	English
Examination Terms	Klausur (100%)
Miscellaneous	-
Module coordinator	Univ.-Prof. Dr. Malte Brettel
ECTS Credits	10
Contact time (WSH)	4
Examination duration (min)	-
Total hours (h)	300,0
Contact hours (h)	60,0

- Sustainable Process Metallurgy and Metal ...
- Wahlpflichtbereich
- + Entrepreneurship 101 - Thinking like an entrepreneur and ...

Self-study hours (h) 240,0

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 1 (802395901)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 2 (802395902)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 3 (802395903)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 4 (802395904)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Start-up CFO 1 (802395905)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Start-up CFO 2 (802395906)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Venture Capital 1 (802395907)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Venture Capital 2 (802395908)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Getting to Market 1 (802395909)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Getting to Market 2 (802395910)	3rd semester	no semester recommended	1	-

▲ Offer node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 1	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 2	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 3	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 4	3rd semester	no semester recommended	-	2

Entrepreneurship 101 - Start-up CFO 1	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Start-up CFO 2	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Venture Capital 1	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Venture Capital 2	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Getting to Market 1	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Getting to Market 2	3rd semester	no semester recommended	-	2

- Sustainable Process Metallurgy and Metal ...
- Fachspezifische Module
- + Process Metallurgy and Recycling of Iron and Steel (5211523)

Module titel	Process Metallurgy and Recycling of Iron and Steel (Compulsory subject)
Identifier	5211523
Version	Angelegt über RWTH API als 1
Duration (Semester)	one semester
Cycle (Semester)	winter/summer semester
Valid from	Winter semester 2015
Valid until	-
Module level	Master
Content	<ul style="list-style-type: none"> • Introduction, historical review; • preparation of ore, production of coke; • thermodynamic, heterogeneous equilibrium, kinetics; • reduction technology, production of Iron; • production of steel; • secondary metallurgy; • casting and solidification • slag in the production of Iron and steel • recycling of the steel scrapes • environment protection and sustainability
Learning Objectives/ Learning Outcomes	<p>Knowledge/Comprehension The students know the most important properties of the production of iron and steel. Application / Analysis The student should be able to describe the plant specific relationship between the aggregates of process, the thermo-chemical properties of each middle-production and the kinetical process procedure. Synthesis / Evaluation Students will get an overview of the steel production route. Further, they gain knowledge about the relation of thermodynamic calculations and industrial applications.</p>
(Study-Specific) Prerequisites	-
(recommended) Requirements	Recommended: Materials Chemistry, Physikalische Chemie
References	<ul style="list-style-type: none"> • F. Oeters, Metallurgy of Steelmaking, Springer Verlag Berlin/Heidelberg • The Making, Shaping and Treating of Steel, AISI Foundation, Pittsburg, 10th Edition • Steel Manual, Verlag Stahleisen Düsseldorf, (2008 or later) • A. Babich, D. Senk, H.W. Gudenau, K.Th. Mavrommatis, Ironmaking Textbook, IEHK, RWTH Aachen (2008) • Seshadri Seetharaman (ed.), Fundamentals of Metallurgy, Woodhead Publ. Cambridge, (2011)
Language	English
Examination Terms	Written exam
Miscellaneous	-
Module coordinator	<p>Modulangebotsorganisator: FB5 Modul-AVModellierungsteamverantwortlicher: Kimberly Meyer B. A. RWTHModulverantwortlicher: Universitätsprofessor Professor h. c. (CN) Dr.-Ing. Dr. h. c. (CZ) Dieter Georg Senk</p>
ECTS Credits	4
Contact time (WSH)	4
Examination duration (min)	0

- Sustainable Process Metallurgy and Metal ...
- Fachspezifische Module
- + Process Metallurgy and Recycling of Iron and Steel (5211523)

Total hours (h)	120,0
Contact hours (h)	60,0
Self-study hours (h)	60,0

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Process Metallurgy and Recycling of Iron and Steel Exam (521152301)	1st semester	no semester recommended	4	0

▲ Offer node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Process Metallurgy and Recycling of Iron and Steel Lecture	1st semester	no semester recommended	-	2
Process Metallurgy and Recycling of Iron and Steel Exercise	1st semester	no semester recommended	-	1

Module titel	Entrepreneurship 101 - Thinking like an entrepreneur and becoming one (Compulsory elective subject)
Identifier	8023959
Version	v1
Duration (Semester)	more semesters
Cycle (Semester)	winter/summer semester
Valid from	Summer semester 2021
Valid until	-
Module level	Master
Content	<p>Participants first gain an insight into the field of entrepreneurship. They can then individually choose which focal topics in the field of entrepreneurship they would like to pursue, depending on their center of interest. Participants are offered a range of micromodules out of which they can design their individual learning path. This enables participants to customize the lecture based on their particular interest. Subjects to choose from, among others, include start-up financing, venture capital, entrepreneurial marketing as well as success factors of founding teams.</p> <p>The lecture takes place exclusively online via edX. The modules are self-paced, allowing participants to complete the modules at their individual learning pace.</p> <p>Due to the individually designable lecture, this course is suitable for participants with and without previous knowledge in this field.</p> <p>To gain an overall understanding of entrepreneurship, it is recommended to first select the micromodules "Thinking & Acting like an Entrepreneur".</p>
Learning Objectives/ Learning Outcomes	The aim of this course is to give the participant a basic insight into the topic of entrepreneurship on one hand, and to deepen their understanding in areas of particular interest on the other hand. This way, the participant gets to know different areas of entrepreneurship. Through exercises and quizzes, the new knowledge is directly applied and practiced.
(Study-Specific) Prerequisites	-
(recommended) Requirements	None.
References	-
Language	English
Examination Terms	Klausur (100%)
Miscellaneous	-
Module coordinator	Univ.-Prof. Dr. Malte Brettel
ECTS Credits	10
Contact time (WSH)	4
Examination duration (min)	-
Total hours (h)	300,0
Contact hours (h)	60,0

Self-study hours (h) 240,0

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 1 (802395901)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 2 (802395902)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 3 (802395903)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 4 (802395904)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Start-up CFO 1 (802395905)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Start-up CFO 2 (802395906)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Venture Capital 1 (802395907)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Venture Capital 2 (802395908)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Getting to Market 1 (802395909)	3rd semester	no semester recommended	1	-
Entrepreneurship 101 - Getting to Market 2 (802395910)	3rd semester	no semester recommended	1	-

▲ Offer node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 1	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 2	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 3	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Thinking & Acting Like an Entrepreneur 4	3rd semester	no semester recommended	-	2

Entrepreneurship 101 - Start-up CFO 1	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Start-up CFO 2	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Venture Capital 1	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Venture Capital 2	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Getting to Market 1	3rd semester	no semester recommended	-	2
Entrepreneurship 101 - Getting to Market 2	3rd semester	no semester recommended	-	2

Module titel	Process Metallurgy and Recycling of Iron and Steel (Compulsory subject)
Identifier	5211523
Version	Angelegt über RWTH API als 1
Duration (Semester)	one semester
Cycle (Semester)	winter/summer semester
Valid from	Winter semester 2015
Valid until	-
Module level	Master
Content	<ul style="list-style-type: none"> • Introduction, historical review; • preparation of ore, production of coke; • thermodynamic, heterogeneous equilibrium, kinetics; • reduction technology, production of Iron; • production of steel; • secondary metallurgy; • casting and solidification • slag in the production of Iron and steel • recycling of the steel scrapes • environment protection and sustainability
Learning Objectives/ Learning Outcomes	<p>Knowledge/Comprehension The students know the most important properties of the production of iron and steel. Application / Analysis The student should be able to describe the plant specific relationship between the aggregates of process, the thermo-chemical properties of each middle-production and the kinetical process procedure. Synthesis / Evaluation Students will get an overview of the steel production route. Further, they gain knowledge about the relation of thermodynamic calculations and industrial applications.</p>
(Study-Specific) Prerequisites	-
(recommended) Requirements	Recommended: Materials Chemistry, Physikalische Chemie
References	<ul style="list-style-type: none"> • F. Oeters, Metallurgy of Steelmaking, Springer Verlag Berlin/Heidelberg • The Making, Shaping and Treating of Steel, AISI Foundation, Pittsburg, 10th Edition • Steel Manual, Verlag Stahleisen Düsseldorf, (2008 or later) • A. Babich, D. Senk, H.W. Gudenau, K.Th. Mavrommatis, Ironmaking Textbook, IEHK, RWTH Aachen (2008) • Seshadri Seetharaman (ed.), Fundamentals of Metallurgy, Woodhead Publ. Cambridge, (2011)
Language	English
Examination Terms	Written exam
Miscellaneous	-
Module coordinator	<p>Modulangebotsorganisator: FB5 Modul-AVModellierungsteamverantwortlicher: Kimberly Meyer B. A. RWTHModulverantwortlicher: Universitätsprofessor Professor h. c. (CN) Dr.-Ing. Dr. h. c. (CZ) Dieter Georg Senk</p>
ECTS Credits	4
Contact time (WSH)	4
Examination duration (min)	0

— Sustainable Metal Forming and Casting

— Fachspezifische Module

+ Process Metallurgy and Recycling of Iron and Steel (5211523)

Total hours (h)	120,0
Contact hours (h)	60,0
Self-study hours (h)	60,0

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Process Metallurgy and Recycling of Iron and Steel Exam (521152301)	1st semester	no semester recommended	4	0

▲ Offer node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Process Metallurgy and Recycling of Iron and Steel Lecture	1st semester	no semester recommended	-	2
Process Metallurgy and Recycling of Iron and Steel Exercise	1st semester	no semester recommended	-	1

Module titel	Fundamentals and Solving Methods in Metal Forming (Compulsory subject)
Identifier	5211536
Version	V2
Duration (Semester)	one semester
Cycle (Semester)	winter/summer semester
Valid from	Winter semester 2018
Valid until	-
Module level	Master
Content	<ul style="list-style-type: none"> • Basics of plastomechanics, stress and deformation states, yield law, differential equations for elementary theory, boundary conditions • Elementary theory for basic metal forming processes • Similarity theorem and modelling techniques, basics of FEM
Learning Objectives/ Learning Outcomes	<ul style="list-style-type: none"> • Knowledge: The students know the possibilities and boundaries of solving methods in metal forming including FEM and similarity theory. • Understanding: The students have a detailed understanding of plastomechanics. • Application and Analysis: The students are able to analyse the basic processes in metal forming, to choose an adequate solving method and to derive the elementary coherences to describe and estimate certain metal forming processes. • Practice: In the practical course, the students learn the possible applications of FEM in the field of forming technology by means of practice-oriented application cases. For this purpose, the students use CLiPS, a web-based application for performing FE simulations, in self-study. Accompanying reports and mutual peer reviews promote the competences in the field of independent research.
(Study-Specific) Prerequisites	-
(recommended) Requirements	none
References	T. Altan: Metal forming, American Society for Metals Lange: Handbook of Metal Forming, Volume 1
Language	English
Examination Terms	Admission only after successfully completion of the practical experiments (Laboratory). Written exam
Miscellaneous	-
Module coordinator	Modulangebotsorganisator: FB5 Modul-AVModellierungsteamverantwortlicher: Kimberly Meyer M. A. RWTHModulverantwortlicher: Universitätsprofessor Dr.-Ing. Gerhard Hirt
ECTS Credits	8
Contact time (WSH)	-

— Sustainable Metal Forming and Casting

— Fachspezifische Module

+ Fundamentals and Solving Methods in Metal Forming (5211536)

Examination duration (min)	-
Total hours (h)	240,0
Contact hours (h)	-
Self-study hours (h)	-

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Laboratory - Fundamentals and Solving Methods in Metal Forming (521153602)	3rd semester	no semester recommended	0	3
Exam - Fundamentals and Solving Methods in Metal Forming (521153601)	3rd semester	no semester recommended	8	0

▲ Offer node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Lecture - Fundamentals and Solving Methods in Metal Forming	3rd semester	no semester recommended	-	2
Tutorial - Fundamentals and Solving Methods in Metal Forming	3rd semester	no semester recommended	-	2

+ Master Thesis Materials Engineering (5226466)

Module title	Master Thesis Materials Engineering (Compulsory subject)
Identifier	5226466
Version	V1
Duration (Semester)	one semester
Cycle (Semester)	summer semester
Valid from	Winter semester 2021
Valid until	-
Module level	Master
Content	Selected task within a research and development project, theoretically or experimentally, including independent information sourcing, structuring of the topic, exposition of the investigations, presentation and defence of the thesis.
Learning Objectives/ Learning Outcomes	Independent working on a problem in the area of expertise of the student within a given period according to scientific methods guided by a supervisor.
(Study-Specific) Prerequisites	Es müssen 82 CPs erreicht sein um die Master Thesis anzumelden
(recommended) Requirements	none
References	-
Language	English
Examination Terms	schriftliche Hausarbeit und mündliche Präsentation. Die Bearbeitungszeit für die Masterarbeit beträgt 6 Monate.
Miscellaneous	-
Module coordinator	-
ECTS Credits	30
Contact time (WSH)	-
Examination duration (min)	-
Total hours (h)	900,0
Contact hours (h)	-
Self-study hours (h)	-

● Exam node

Title	Recommended Semester (Study start winter)	Recommended Semester (Study start summer)	ECTS Credits	Contact time (WSH)
Master Thesis incl. Colloquium (522646601)	4th semester	no semester recommended	30	-